REMARKS

Claims 1, 2, 4, 6, 8, 10-12, 14 and 16-18 are pending in this application, of which claims 1, 2, 17 and 18 have been amended. No new claims have been added.

The Examiner has maintained from the previous Office Action all of the prior art rejections of pending claims 1, 2, 4, 6, 8, 10-12, 14 and 16-18, all of which are respectfully traversed.

In regard to the 35 USC §103(a) rejection of claim 1 as unpatentable over **Ouderkirk et al.** in view of **Crawford et al.**, **Kikuchi et al.** and **Arakawa**, two points should be emphasized:

1. Applicants have previously argued that these references cannot be combined to teach the use of a super twisted nematic liquid crystal or a retardation film having the relation nx>nz>ny in combination with a reflection-type polarizing film, as recited in claim 1 of the instant application. As we noted in our previous response, **Arakawa** and **Kikuchi et al.**, cited as prior art in **Crawford et al.**, do not relate to reflection-type polarizing films, and therefore are not combinable with **Ouderkirk et al.** to teach the present invention. Furthermore, as also previously noted, claim 1 of **Crawford et al.**, from which claim 4 depends, discloses a first negative retardation film interposed between the liquid crystal layer and the front polarizer (which film corresponds to the retardation film recited in claim 1 of the instant application) which has indices of refraction described by the equation $n_{z1}<n_{x1}=n_{y1}$, which does not meet the relation of nx>nz>ny, where nx is the refractive index in the direction of the phase delay axis, ny is the refractive index in the Y-axis direction, and nz is the refractive index in the thickness

direction.

Thus, **Crawford et al.**, although disclosing the "nx>nz>ny" relation for the retardation film as prior art, teaches away from this relation in its invention disclosure, including claim 1.

The present invention solves problems which arise when an STN liquid crystal cell and a reflection-type polarizing film are combined, by providing a retardation film having relations nx > ny > nz or a twisted retardation film at an appropriate position, and thereby a favorable reflection display can be realized.

These functions and effects are not obvious from the combination of **Crawford et al.**, which discloses an STN liquid crystal cell and a retardation plate; or **Ouderkirk et al.**, which discloses a reflective polarizer.

2. FIGS. 9a, 9b and 10-12 of **Ouderkirk et al.** show a diffusion element 6 adjacent and outside of a reflective polarizer element 8.

This is in contrast to the present invention, in which a light absorbing film 11 is arranged outside and adjacent to reflection-type polarizing film 10, as shown in Fig. 2 of the instant application. In the present invention, the light diffusion layer 9 is arranged outside and adjacent to the absorption-type polarizing film 8, as shown in Fig. 2 of the instant application.

Regarding the 35 USC §103(c) rejection of claims 2, 4, 6, 14 and 16 as unpatentable over **Ouderkirk et al.** in view of **Crawford** and **Bosma et al.**, Applicants noted in their previous response that **Bosma et al.** discloses retardation layers based on a super-twisted nematic (STN) liquid crystalline layer. In the retardation layers, the liquid crystalline polymer is placed between

glass substrates in which at least one substrate has a thickness of 20-500 micrometers. The use of such thin glass substrates reduces the weight and thickness of the retardation layer.

Column 2, lines 53-56 disclose that the LC polymer film may be placed between "the polarizer and a thin glass substrate". However, column 2, lines 9-10 disclose that "a retardation layer having an angle of rotation of 0° may be used as a polarizer".

Bosma et al. fails to disclose that the polarizer is a reflection-type polarizing film, as recited in claim 2 of the instant application. As noted in Applicants' previous response, by providing the twisted retardation film recited in claim 2 into a liquid crystal display device wherein an STN liquid crystal cell and a reflection type polarizing film are combined, specific effects can be realized. The effects are described from page 20, line 14 to page 21, line 20 of the specification.

If the twisted retardation film 14 is not provided, there occurs a problem in that the light linearly polarized in the direction parallel to the transmission axis 8a which is incident from the absorption-type polarizing film 8 assumes an elliptically polarized state after passing through the STN liquid crystal cell 17. It is therefore unnecessarily colored by the reflection-type polarizing film 10 or cannot pass through as a completely linearly polarized light.

However, by disposing a twisted retardation film in front of the STN liquid crystal cell, the incident linearly polarized light assumes an elliptically polarized state, and returns to "a substantially completely linearly polarized light" when passing through the STN liquid crystal cell. When the substantially completely linearly polarized light falls on the reflection-type polarizing film, "the whole incident light is reflected by the reflection-type polarizing film 10,

which appears as a metallic silver background".

That is, the twisted retardation film compensates a polarization state of the incident light to render the incident light to fall on the reflection-type polarizing film not in a state elliptically polarized but in a state substantially completely linearly polarized, thereby realizing a favorable reflection state.

As described above, the present invention solves problems which arise when an STN liquid crystal cell and a reflection-type polarizing film are combined, by providing a retardation film having relations nx > ny > nz or a twisted retardation film at an appropriate position, and thereby a favorable reflection display can be realized.

A super twisted nematic liquid crystal cell is sometimes used in combination with a retardation film or a twisted retardation film, but it is also well known that the cell is sometimes used independently without the films. In the case where the super twisted nematic liquid crystal cell is used without the retardation film, the light after passing through the liquid crystal cell in a state with no voltage applied becomes an elliptically polarized light even if a linearly polarized light transmitted through an absorption-type polarizing film is incident on the liquid crystal cell.

The elliptically polarized light contains light components with various polarizing direction, and the reflection-type polarizing film reflects light in only one polarizing direction. Accordingly, when the elliptically polarized light is incident on the reflection-type polarizing film, only a part of the light can be reflected there, resulting in deterioration of reflectance and darker display.

However, if a retardation film or a twisted retardation film is provided to compensate a

light to be a substantially linearly polarized light after passing through the super twisted nematic liquid crystal cell, not to be an elliptically polarized light, and further the reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is located in consideration of the polarizing direction of the compensated linearly polarized light, almost all of the light after passing through the liquid crystal cell in a state with no voltage applied can be reflected by the reflection-type polarizing film, resulting in a brighter display.

That is, in the case where a super twisted nematic liquid crystal cell is used with a reflection-type polarizing film, provision of a retardation film or a twisted retardation film for compensation of a light after passing through the liquid crystal cell to a linearly polarized light and disposition of the reflection-type polarizing film in consideration of the direction of polarization of the compensated linearly polarized light realizes an STN liquid crystal display device which can display a large amount of information with both of the characteristics that the display sharply change in accordance with the applied voltage and a bright and metallic characteristic of the reflection-type polarizing film is utilized. This is the effect of the invention.

Crawford, **Kikuchi**, **Arakawa**, **Bosma et al.**, **Ouderkirk et al.**, disclose only respective elements of some kinds of retardation films, reflection-type polarizing film, or so on for an independent application without relation between the elements, and these references do not disclose or suggest the structure (according to claims after amendment) for realizing both of the characteristics of the STN liquid crystal display device and the reflection-type polarizing film.

To more clearly distinguish the present invention over the cited references, claims 1, 2, 17 and 18 have been amended to recite that:

> ...[S]aid reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied

These amendments are based on the description from page 9, line 18 to page 10, line 11 and from page 20, line 14 to page 21, line 20 of the specification for the "orthogonal" case, and from the description from page 11, line 24 to page 12, line 5 for the "parallel" case.

The "orthogonal" case corresponds to the structure for a colorful display in a metallic background, and the "parallel" case corresponds to that for a metallic display in a colorful background, as disclosed on page 2, lines 8-13 of the specification.

Thus, the prior art rejections should be withdrawn.

In view of the aforementioned amendments and accompanying remarks, claims 1, 2, 4, 6, 8, 10-12, 14 and 16-18, as amended, are in condition for allowance, which action, at an early date, is requested.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**."

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosures: Version with markings to show changes made

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VERSION WITH MARKINGS TO SHOW CHANGES MADE 09/269,503

IN THE CLAIMS:

Please amend claims 1, 2, 17 and 18 as follows:

1. (Twice Amended) A liquid crystal display device, comprising:

a super twisted nematic liquid crystal cell in which nematic liquid crystal having a twist angle in the range from 180° to 270° is filled and sandwiched between a transparent first substrate having a first electrode and a transparent second substrate having a second electrode;

a retardation film provided outside said second substrate;

an absorption-type polarizing film provided outside the retardation film for absorbing light linearly polarized in the direction orthogonal to the transmission axis;

a reflection-type polarizing film provided outside said first substrate for reflecting light linearly polarized in the direction orthogonal to the transmission axis;

a light absorbing member provided outside the reflection-type polarizing film; and

a light diffusion layer provided on the outside surface of said absorption-type polarizing film,

wherein said retardation film has relations of nx > nz > ny, where nx is the refractive index in the direction of the phase delay axis, ny is the refractive index in the Y-axis direction, and nz is the refractive index in the thickness direction, and

wherein said reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization

of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied.

2. (Amended) A liquid crystal display device, comprising:

a super twisted nematic liquid crystal cell in which nematic liquid crystal having a twist angle in the range from 180° to 270° is filled and sandwiched between a transparent first substrate having a first electrode and a transparent second substrate having a second electrode;

a twisted retardation film provided outside said second substrate;

an absorption-type polarizing film provided outside the twisted retardation film for absorbing light linearly polarized in the direction orthogonal to the transmission axis;

a reflection-type polarizing film provided outside said first substrate for reflecting light linearly polarized in the direction orthogonal to the transmission axis; and

a light absorbing member provided outside the reflection-type polarizing film, and

wherein said reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said twisted retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied.

17. (Amended) A liquid crystal display device, comprising:

a super twisted nematic liquid crystal cell in which nematic liquid crystal having a twist angle in the range from 180° to 270° is filled and sandwiched between a transparent first substrate having a first electrode and a transparent second substrate having a second electrode;

a retardation film provided outside said second substrate;

an absorption-type polarizing film provided outside the retardation film for absorbing light linearly polarized in the direction orthogonal to the transmission axis;

a reflection-type polarizing film provided outside said first substrate for reflecting light linearly polarized in the direction orthogonal to the transmission axis; and

a color filter as a light absorbing member provided outside the reflection-type polarizing film,

wherein said retardation film has relations of nx > nz > ny, where nx is the refractive index in the direction of the phase delay axis, ny is the refractive index in the Y-axis direction, and nz is the refractive index in the thickness direction, and

wherein said reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied.

18. (Amended) A liquid crystal display device, comprising:

a super twisted nematic liquid crystal cell in which nematic liquid crystal having a twist angle in the range from 180° to 270° is filled and sandwiched between a transparent first substrate having a first electrode and a transparent second substrate having a second electrode;

a retardation film provided outside said second substrate;

an absorption-type polarizing film provided outside the retardation film for absorbing light linearly polarized in the direction orthogonal to the transmission axis;

a reflection-type polarizing film provided outside said first substrate for reflecting light linearly polarized in the direction orthogonal to the transmission axis; and

a solar cell as a light absorbing member provided outside the reflection-type polarizing film,

wherein said retardation film has relations of $nx > nz > ny$, where nx is the refractive index in the direction of the phase delay axis, ny is the refractive index in the Y-axis direction, and nz is the refractive index in the thickness direction, and

wherein said reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied.